A

PROBATIONARY

SURGICAL ESSAY

ON

CAROTID ANEURISM:

SUBMITTED

BY THE AUTHORITY OF THE PRESIDENT

AND HIS COUNCIL,

TO

THE EXAMINATION OF

The Royal College of Surgeons of Edinburgh,

WHEN CANDIDATE

FOR

ADMISSION INTO THEIR BODY,

IN CONFORMITY TO THEIR REGULATIONS

RESPECTING

The Admission of Ordinary Fellows.

BY

THOMAS INGLIS, M. D.

EXTRAORDINARY MEMBER OF THE ROYAL MEDICAL SOCIETY OF EDINBURGH.

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TO

ANDREW INGLIS, M. D.

FELLOW OF THE ROYAL COLLEGE OF SURGEONS;

OF WHICH INCORPORATION

HE,

HIS FATHER,

AND

GRANDFATHER,

HAVE BEEN MEMBERS FOR ONE HUNDRED YEARS;

THIS ESSAY

IS DUTIFULLY INSCRIBED

BY HIS SON,

THOMAS INGLIS.

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CAROTID ANEURISM.

Of the numerous diseases presented to the care of the Surgeon, few can possess a stronger claim to his attention than Aneurism. Till within these few years, the interesting variety of the disease, which forms the subject of this Essay, was considered as incurable; and it was left to the boldness and dexterity of the British Surgeon to show the practicability of effecting a permanent cure.

In the following pages I propose first to offer a few general observations on the struc-

ture of arteries, together with a more particular account of the connection of the common carotid arteries with the surrounding parts. I shall next proceed to give the history, and more striking symptoms which characterize carotid Aneurism, with a short account of the formation of Aneurism. I shall then endeavour to point out the distinguishing marks between this and other diseases, the circumstances by which we are to regulate our prognosis; and lastly, the different modes of treatment that have been recommended for the cure of the disease.

Of the Structure of Arteries.

The arteries are membranous tubes, conveying the blood from the heart to the most remote parts of the body. Anatomists have generally described three coats as proper to them;

namely, the internal or serous, the middle or muscular, and the external or cellular.

The internal coat is very thin and transparent; it is of a close texture, and is highly polished on its inner surface; it is elastic, and in its longitudinal direction is strong, but it is " so weak in the circular as to be very easily torn by the slightest force in that direction."*

The middle coat, called by Bichat " le tissu arteriel," is composed of several layers or strata of muscular fibres which surround the artery. These fibres vary in colour in different subjects, and at different periods of life; in youth they are of a pale red colour, but in age they are of a yellowish hue; they run in a circular direction, and are easily lacerated.

The cellular coat is composed of very fine threads, which connect it to the neighbour-

* Jones on Hemorrhage, p. 1.

ing parts. Internally this is condensed into a firm, compact, and filamentous membrane; it is very elastic, and so strong that a force which lacerates the coats beneath, makes little or no impression on it. Mr Burns, in describing the structure of arteries, considers this coat as two, the internal, or that named by Vesalius, the membranous, and by Senac, the tendinous coat; and the external, which is of a more open texture, he calls the cellular.

Of the Connection of the Common Carotid Arteries with the surrounding Parts.

The common carotid artery, from the lower part of the neck to the place where it divides into the external and internal carotid arteries, is connected with vessels and nerves of the

utmost importance. Inclosed in the same sheath with it we find the internal jugular vein, and the eighth pair of nerves, and sometimes also the descending branch of the ninth pair, though this is generally placed exterior to the sheath. The sympathetic nerve also lies exterior to the sheath, between it and the longus colli muscle, to which it is connected by cellular membrane. The internal jugular vein is situated to the outer side of the artery, and the par vagum is placed between them. In describing the situation of these important vessels and nerves, with a reference to the operation of taking up the common carotid artery, Mr Burns divides the neck into three regions, the lower, middle, and upper. He says, "the middle region will be defined by drawing a line from the root of the mastoid process to the junction of the horn with the body of the os hyoidis, by running another from the anterior edge of the mastoid

process to the centre of the upper bone of the sternum, and by extending a third from the side of the body of the hyoid bone to near the centre of the clavicle. By these three lines a portion of the side of the neck, nearly of a triangular shape, is insulated; along the whole extent of this, which forms the middle region of the neck, the carotid artery is accompanied by the nerves and jugular vein, and in this portion these parts are very superficial; they are merely covered by the integuments, the platysma myoidis, the fascia of the neck, and their own cellular sheath. Here, then, is the proper spot, provided the place be in our choice to lay bare the vessel, to take it up; lower in the neck it is deeper seated, and higher up it is sunk behind the angle of the jaw." * Along the whole of this region the common

* Burns' Surgical Anatomy of the Head and Neck, p. 71.

carotid artery is also accompanied by the glandulæ concatenatæ, some of which are situated anterior to, others posterior to the artery, and from their connection with it, when in an enlarged state, are sometimes taken for Aneurism.

The place at which the artery bifurcates varies in different subjects; generally however the division takes place opposite the upper margin of the thyroid cartilage; though in this as in other arteries there is a great variety; the artery sometimes dividing much lower down, in other cases not dividing till opposite the angle of the lower jaw.

HISTORY.

Aneurisms of the carotid arteries most frequently arise at the point where the common carotid divides into its two great branches, the

external and internal carotid arteries; this situation being very liable to depositions of calcareous matter, and to preternatural dilatations.

The history and progress of the symptoms may be divided into three distinct stages.

Except in such cases as evidently arise either from a laceration of the internal coats, in consequence of over exertion, or from puncture of the artery, the disease comes on gradually, and in general makes some progress before it is noticed. When first observed, the tumour is soft and small; it is situated near the angle of the lower jaw, and it has a strong pulsatory motion; the integuments covering it are not discoloured, and the patient is sensible of little pain or uneasiness from it. It is more or less circumscribed or diffused, smooth or unequal on its surface, according to the length of time the disease has existed. In this stage the tumour may be made nearly to disappear

by the application of pressure on the artery, between the tumour and the heart; but on the removal of this it quickly regains its former magnitude. Its growth is very various, in some cases very slow, being almost stationary for weeks together; in others running its course with great rapidity.

The second stage differs from the first in several points. The tumour is much increased in size, it gradually becomes harder, except at the spot where the blood is passing from the artery into the orifice of the sac; it is less easily compressed, from the formation of coagulum; and even when the pressure is continued for a long time, the tumour is not much diminished in size. In this stage the pulsation of the tumour by degrees becomes less and less perceptible, and is at last nearly lost. The patient suffers excruciating agony from a pain in his head, and a sense of pulsation in the arteries of the neck and brain.

From the pressure of the tumour on the pharynx and larynx, his deglutition becomes impaired; he is troubled with cough and difficulty of breathing; and in a case which occurred to Mr Astley Cooper, whenever the patient attempted to stoop, "he had an insupportable feeling as if his head would burst; a giddiness; loss of sight; and almost total insensibility." *

The third stage is that which immediately precedes the bursting of the tumour. This is not always sudden, a regular process goes on, and in most cases the patient sinks under repeated small bleedings, rather than from a copious and sudden hemorrhage. The process seems to be the following. The skin in the middle of the tumour becomes discoloured, a slight inflammation comes on, which is not of a healthy kind, the colour not being of a florid red, but rather of a livid hue; over this

* Medico-Chirurgical Transactions, vol. I. p. 225.

the skin desquamates, and the surface appears blistered; the vesications separate, and on applying the finger below them, the part appears devoid of sensibility. In a few days an eschar is formed; a line of separation next appears around the eschar; this increases till it reaches the sac; a complete circle of ulceration is now formed, and a small aperture is made, through which a little blood escapes; if a piece of lint is applied, it will stop the bleeding for a time; the aperture however increases in size, more blood makes its escape; this is perhaps stopped by the clots; it breaks out again and again, and the patient at last sinks under the repeated hemorrhage. This is the most common termination of the disease; not unfrequently however the Aneurism bursts on the patient's making some sudden motion, and life is at once destroyed. Carotid Aneurism also often proves fatal by pressing on the pharynx and larynx, producing an irritable

state of these parts, and ultimately impeding deglutition and respiration.

Formation of Aneurism.

Aneurisms have generally been described, in systematic works on Surgery, as being formed either by the preternatural dilatation of a part of an artery, or by the rupture of its internal coats, in consequence of which the blood is effused into the cellular coat, which becomes condensed into a cyst. The former of these varieties has been denominated *True*, the latter *Spurious* Aneurism.

Till Scarpa published his valuable work on Aneurism, the propriety of the above arrangement was generally admitted, though the doctrine of the disease being universally caused by the rupture of the internal coats, had been maintained by many early writers on the

subject. Scarpa concludes, from his observations and dissections with regard to Aneurism in general, but more especially with regard to that of the aorta, that the disease is always produced by the rupture of the middle and internal coats of the artery, and is in no instance formed by their dilatation, but undoubtedly by the cellular coat, which the artery receives in common with the surrounding parts; that there are none of those signs which are considered as characteristic of Aneurism from dilatation which may not be observed in Aneurism from rupture, including even the circumscribed form of the tumour; and therefore, "that the distinction of Aneurism into True and Spurious, adopted in the schools, is only the production of a false theory; since observation shews, that there is only one form of the disease, or that caused by a rupture of the proper coats of the artery, and an effusion of arterial blood into the cel-

lular sheath which surrounds the ruptured artery." * The most frequent cause of this rupture is said by Scarpa to be " the slow morbid, ulcerated, steatomatous, fungous, squamous degeneration of the internal coats of the artery." †

Scarpa's views with regard to the formation of Aneurism have not been universally adopted, though they are generally admitted to be correct in the majority of cases. The latest observations on the subject are by Mr Hodgson, in his treatise on the Diseases of Arteries and Veins. His deductions are a modification of the various doctrines that have been at different times maintained; he briefly states them as follows. " 1st. Numerous Aneurisms are formed by the destruction of the internal and middle coats of an artery, and the expansion

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* Scarpa on Aneurism, translated by Wishart, p. 113.

† Scarpa on Aneurism, translated by Wishart, p. 83.

of the external coat into a small cyst, which giving way from distention, the surrounding parts, whatever may be their structure, form the remainder of the sac; and, 2dly, sometimes the disease commences in the dilatation of a portion of the circumference of an artery. This dilatation increases till the coats of the vessel give way, when the surrounding parts form the sac, in the same manner as when the disease is in the first instance produced by the destruction of the coats of an artery."*

Aneurism from rupture is most frequently formed in the following manner. In the commencement of the disease the internal coat looses its smoothness, and becomes irregular and wrinkled; an opacity begins in numerous spots, which are of an earthy or

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* Hodgson on the Diseases of Arteries and Veins, p. 74.

steatomatous nature; on these yielding to the impetus of the blood, an absorbing process takes place, and the coat is rendered so brittle as gradually to give way. The blood next begins to ooze through the connections of the muscular coat, and becomes effused into the interstices of the cellular coat. A layer of coagulum is then deposited on the inner surface of this coat, which glues it together, and converts it into the aneurismal sac. The remains of the internal coats are gradually absorbed; layer after layer of coagulum is deposited; the tumour pressing on the surrounding parts causes their absorption; new parts come in contact with it, which successively form the aneurismal sac; these are in their turn absorbed, and the Aneurism at last reaches the surface, and gives way in the manner already described. When the Aneurism commences with a dilatation of the coats of the artery, its progress at first is slow, but after the internal

coats have given way, it rapidly proceeds to its fatal termination.

DIAGNOSIS.

Aneurisms of the arch of the aorta, and of the arteria innominata, and tumours situated on the neck, are the diseases most liable to be taken for carotid Aneurism.

Aneurisms of the arch of the aorta, and of the arteria innominata, frequently make their first appearance at the lower part of the neck. Their protrusion in an anterior direction is resisted by the sternum and clavicles, which form a stricture at the root of that portion which projects externally, and in some cases this stricture is so considerable that it appears possible to tie the artery between the tumour and the chest. Mr Hodgson relates a case in which it was proposed to tie the carotid ar-

tery for an Aneurism, which upon dissection was found to have arisen from the arch of the aorta and the arteria innominata.* In such cases an attentive enquiry into the previous history of the case will, I think, in most cases, enable us to ascertain the true seat of the disease.

When any of the glands which accompany the common carotid artery are enlarged, the tumour, from its connections with the artery, has frequently many of the characters of Aneurism, and may sometimes be mistaken for that disease. This mistake is most likely to happen when the artery is projected on the front of the swelling, but even here there can be little difficulty in distinguishing the disease from real Aneurism. " The defined course of the pulsation, its being only felt along a particu-

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* Hodgson on the Diseases of Arteries and Veins, p. 90.

lar part of the swelling, and the unchangeable nature of the tumour, lead to an acquaintance with the disease. The symptoms are, indeed, such as would only lead the most ignorant to a supposition of Aneurism."*

PROGNOSIS.

When this disease is left to itself, and no attempt is made to relieve it by a chirurgical operation, it almost invariably proves fatal, the medical treatment recommended for the cure of Aneurism only retarding for a short time its fatal issue. Before proceeding to an operation, we must carefully inquire into the history of the case, with a view to ascertain whether the disease is complicated with in-

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* Burns' Surgical Anatomy of the Head and Neck, p. 84.

ternal Aneurism or not. If we feel convinced that such exist, the operation ought not to be performed. Surgeons ought not, however, to be deterred from the operation, except the evidence of the existence of internal Aneurism be so strong as to leave little doubt on their minds.

When the patient is of an advanced age, when the tumour has been of long continuance, and is so large as to leave little space for securing the artery, and when there is an appearance of gangrene on its surface, the chance of success from an operation is not great.

On the contrary, if the tumour is small, and situated high up in the neck, if the patient is middle aged, if he is of a spare habit of body, and is not of an irritable constitution, we have every reason to believe that an operation will prove successful.

Method of Cure.

In this division of my subject, I shall first shortly state the medical treatment which has been found most useful in the cure of Aneurism, and shall next proceed to describe the manner in which the operation of taking up the common carotid artery has been usually performed.

Medical Treatment.—In cases where the operation is either inadmissable, or where the patient will not submit to it, the indication which presents itself is, to lessen the force of the circulation so much as to promote the deposition of coagulum, by which the cavity of the Aneurism, and of the artery leading to it, may be filled up, and a permanent cure effected. The copious and repeated detraction of blood, the frequent use of purgatives, the ex-

hibition of digitalis, the keeping the patient in a state of rest, a diet so meagre as not to be more than sufficient to support life, and a careful avoidance of all stimulant substances, are the means best suited to fulfil this indication. Petit mentions a case of carotid Aneurism, in which the above plan of treatment was tried with success. The tumour, which was situated under the angle of the lower jaw, was about the size of a pigeon's egg when the patient came first under his charge; at the end of three months it was reduced to half its size, and in two or three years a hard knot could only be felt. It remained in this condition for seven years, at the end of which period the patient was seized with apoplexy, and died after a few days illness. On examining the body, the right carotid artery was found obliterated from the place at which it separates from the subclavian artery to the point of its bifurcation. It was converted

into a slender cord, in which no vestige of a cavity could be detected.* In most cases, however, no such favourable termination is to be expected from this plan of treatment. The patient's life is perhaps prolonged for a short time, the severity of the symptoms are relieved, but sooner or later he falls a victim to the disease.

Operation.—The propriety of tying the common carotid artery for the cure of Aneurism has now been completely proved, the operation having been performed several times with success.

Mr Astley Cooper was the first surgeon who performed this operation for the cure of Aneurism. He was convinced, that the functions of the brain would not suffer any

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* Memoires de l'Academie Royale des Sciences de l'Ann. 1765, p. 758.

permanent injury from a ligature being applied to one of the common carotid arteries, being led to this opinion, both from the circumstance of several instances of the obliteration of this artery having occurred to different anatomists in the course of their dissections,* and also from his having made the experiment of tying the carotid arteries of dogs, without producing any disorder of their vital functions.† The first patient on whom Mr Cooper had an opportunity of tying the common carotid artery, was a woman of about forty-four years of age. The tumour was

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* Dr Baillie, in examining the body of a man, found the right carotid obliterated, and the canal of the left much diminished in size.—Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, vol. I. p. 121. A case is also described by Mr Cooper, in which the left carotid was obliterated by an Aneurism of the arch of the aorta.—Medico-Chirurgical Transactions, vol. I. p. 12.

† Medico-Chirurgical Transactions, vol. I. p. 223.

of a large size; it occupied about two-thirds of the neck, and extended from the angle of the lower jaw, to within two inches and a half of the clavicle. An incision was made through the skin and platysma myoidis about two inches long, on the anterior margin of the sterno-mastoid muscle, from the lower part of the tumour to the clavicle, which laid bare the omo-hyoideus and sterno-hyoideus muscles. On drawing these aside, the jugular vein came into view. The motion of this vein produced the principal difficulty in the operation, as under the different states of breathing, it was sometimes presented to the knife tense and distended, and then as suddenly collapsed. Mr Cooper having passed his finger into the wound to confine that vein, in the next place made an incision on the carotid artery, and having laid it bare, he separated it from the par vagum, and passed an aneurismal needle, armed with a double

ligature, under it, taking care to exclude the accompanying nerves. The two ligatures were then tied about half an inch asunder, being the greatest distance to which they could be separated. The artery was not divided between them, from a fear of their being thrown off by the force of the circulation, the distance being too small to allow of any means being used to prevent this occurrence. As soon as the ligatures were tied, all pulsation in the tumour ceased, and the operation being terminated, the wound was superficially dressed. On the day after the operation, the pulsation in the tumour had not returned, and there was no appearance of a diminution of nervous energy in any part of the body. This patient died at the end of nineteen days, and on examination the cause of her death was found to be, the inflammation of the aneurismal sac, and the parts adjacent, by which the tumour had become so much increased in

size, as to press on the pharynx, and prevent deglutition, and upon the larynx, so as to excite violent fits of coughing, and ultimately to impede respiration.*

Mr Cooper was not discouraged by the event of this operation, but determined to repeat it in the first favourable case that should occur to him. He had the good fortune some time after to meet with a case in all respects suited to his wishes. The patient was about fifty years of age; he possessed great firmness of mind, and was of a very unirritable constitution. The tumour was situated just below the angle of the lower jaw, and was only about two inches and a half in diameter; and the neck was of considerable length, which allowed a sufficient space for exposing the common carotid artery. The first steps of the operation were performed nearly in the

* Medico-Chirurgical Transactions, vol. I. art. 1.

same manner as in the first case. After the artery was exposed, two ligatures were carried under it, the lower of which was immediately tied. The artery was next detached from the surrounding parts to the extent of an inch above the lower ligature, and the upper was then tied. A needle and thread was next passed through the artery above the one ligature and below the other; and, lastly, the artery was divided between the two ligatures. The lips of the wound were then drawn together by adhesive straps, the ligatures being left hanging from each end of the wound, and a piece of lint was laid on, which was retained by adhesive straps. The pulsation in the tumour continued for some months after the operation, but gradually became obscure, and at last entirely ceased. The ligatures did not come away till the twenty-second and twenty-third days, and the wound was a considerable time in healing.

The tumour was gradually absorbed, and at the end of eight months it had entirely disappeared. The patient was discharged cured, and returned to his former employment, and though nine years have elapsed since the performance of the operation, he is still, I believe, in perfect health.*

Some difference of opinion has arisen concerning the manner of applying the ligature for the cure of Aneurism; some surgeons recommending the employment of two ligatures, others preferring only one.† As hemorrhage frequently follows the use of the single ligature, we find that the double ligature has been most generally preferred in carotid Aneurism, and from a fear of the lower

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* Medico-Chirurgical Transactions, vol. I. art. 17.

† Mr Lawrence recommends a middle-sized washed silk ligature, the ends of which being cut off near the knot, the wound is to be united as a simple incision.—Medico-Chirurgical Transactions, vol. VI. p. 199.

ligature being thrown off by the force of the circulation, the artery has in the greater number of cases been left undivided.

The experiments of Dr Jones having proved that the effect of applying a ligature to an artery is the division of the internal and middle coats, and the consequent effusion of lymph from the cut surfaces into the cavity of the vessel, it appeared probable to Mr Travers, that if the ligature was removed at the end of a few hours, the adhesion of the opposite sides of the artery would be so far effected as to ensure the obliteration of the canal, and that by this removal of the ligature the final cure would be much hastened. With this idea he performed a series of experiments, which are detailed at considerable length in the fourth and sixth volumes of the Medico-Chirurgical Transactions; by these he found, that if a ligature was applied from six to twelve hours on the carotid artery of a

horse, and then removed, the adhesion was sufficiently complete to effect the permanent obliteration of the canal. Experience only can determine whether similar effects will be produced on the human subject; but it would appear from a case narrated in the seventh volume of the Medico-Chirurgical Transactions, that the adhesive process does not proceed with the same rapidity in them as in the lower animals.*

On the subject of effecting the obliteration of arteries, a very interesting paper has been lately given to the world by Mr Crampton, in the seventh volume of the Medico-Chirurgical Transactions. He objects to the drawing of conclusions with regard to the human species from the results of experiments on the inferior animals, on account of the great facility with which the process of

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* Medico-Chirurgical Transactions, vol. VII. p. 370.

adhesion takes place in them after the wounds of arteries, as it has been found impossible to produce Aneurism in this class of animals. He endeavours to prove, both from observation and experiment, " 1. That the obliteration of an artery can very certainly be effected, independently of the rupture or division of any of its coats. 2. That this operation of the ligature, so far from being essential to the process, not unfrequently defeats it."* To support this view of the bad effects produced by the ligature, he adduces a case described by Warner, in his Cases in Surgery, in which the artery repeatedly ruptured above the ligature.† As many instances have been recorded of arteries being obliterated by the pressure of tumours, he conceives that we are not warranted to conclude that the internal and middle coats of the artery

* Medico-Chirurgical Transactions, vol. VII. p. 344.

† Warner's Cases in Surgery, 4th Edit. p. 139.

must be divided, in order to produce adhesion of its sides; and since the rupture of these coats sometimes causes hemorrhage and Aneurism, he concludes, that a moderate degree of irritation, aided by pressure sufficient to bring the internal surfaces into contact, will prove sufficient to effect the permanent obliteration of the canal; he therefore recommends the employment of the "presse artère," and describes several cases in which it had been used with success.

Since Mr Cooper tied the common carotid artery for the cure of Aneurism, the operation has been performed several times with success. Mr Travers tied this artery for a disease in the orbit resembling that termed by Mr John Bell, Aneurism by anastomosis,* and

* Medico-Chirurgical Transactions, vol. II. art. 1.—In a case of a similar nature, Mr Dalrymple of Norwich succeeded in effecting a complete cure by the performance of this operation.—Medico-Chirurgical Transactions, vol. VI. art. 7.

it has been performed several times for wounds of the carotid arteries,* and in the extirpation of tumours,† and it has been lately recommended in cases of hemorrhage from

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* Examples of wounds of these arteries successfully treated by the application of a ligature to the common carotid, are related by Mr Fleming,—Medico-Chirurgical Journal and Review, vol. III. p. 1; by Mr Hodgson, in his Treatise on the Diseases of Arteries and Veins, p. 329; by Mr Collier, in Medico-Chirurgical Transactions, vol. VII. art. 5; and by Mr Macauly, in Edinburgh Medical and Surgical Journal, vol. X. p. 178.

† Mr Goodlad gives an interesting history of a tumour successfully removed from the face and neck, by previously tying the carotid artery.—Medico-Chirurgical Transactions, vol. VII. art. 6. And Mr Wishart states, in a note in his translation of Scarpa on Aneurism, p. 381, that "Hebenstreit, in the fifth volume of his translation of Mr B. Bell's System of Surgery, mentions a case he met with, where the external carotid artery was wounded in the extirpation of a schirrhous tumour. The profuse hemorrhage which instantly ensued would soon have destroyed the patient, if the surgeon had not immediately recollected himself, and tied the trunk of the artery. The operation was successful, and the patient lived many years after it."

ulceration opening into the internal branches of the artery.*

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* In a case described by Mr C. Bell, in which an ulcer opened into the internal carotid artery, the performance of this operation might perhaps have saved the patient.—Bell's Surgical Observations, vol. I. p. 89.

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